Small Business Innovation Research/Small Business Tech Transfer

Alumina Fiber-Reinforced 9310 Steel Metal Matrix Composite for Rotorcraft Drive System Components, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

AISI 9310 nickel-chromium-molybdenum alloy steel is used extensively in military helicopter rotor shafts and gears. This reliable alloy provides excellent fatigue life combined with high hardness, elastic modulus, and tensile strength. However, to facilitate rapid speed changes of variable drive systems in high-performance rotorcraft, these steel components must weigh less and have lower rotational inertia. Ultramet will develop and demonstrate a material system consisting of continuous alumina fiber-reinforced 9310 steel. Relative to the unmodified alloy, this material system will offer reduced weight, increased strength, and increased stiffness while maintaining the excellent heat treatment properties and hardening schedules of 9310 steel. The composite will be lighter than the base alloy by 15–23%, possess significantly higher specific strength and stiffness, maintain comparable corrosion resistance, and allow the continued use of proven 9310 steel. The composite will be produced using an innovative variant of Ultramet's rapid, low-cost pressureless melt infiltration technology previously demonstrated for fabrication of fiber-reinforced ceramic matrix composites.

Primary U.S. Work Locations and Key Partners

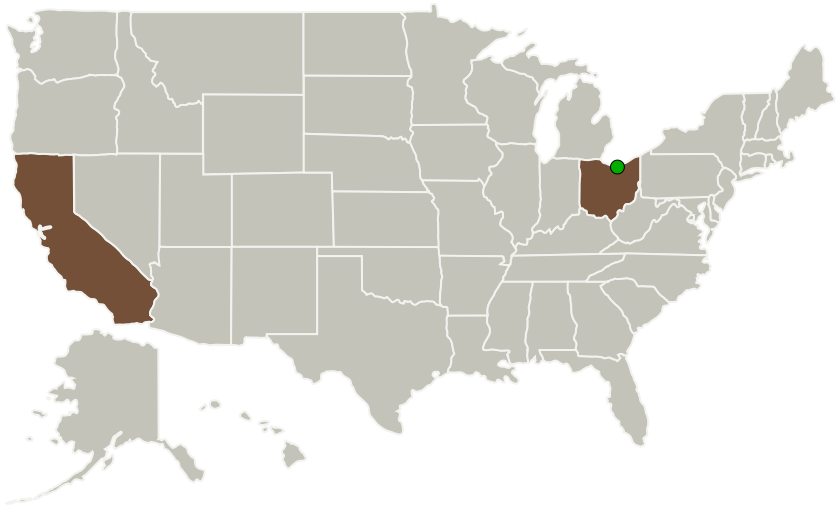

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Table of Contents

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Organizations Performing Work	Role	Type	Location
Ultramet	Lead Organization	Industry	Pacoima, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138812)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ultramet

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

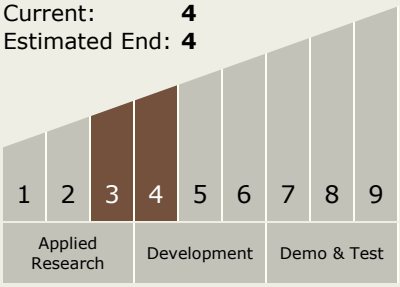
Carlos Torrez

Principal Investigator:

James Selin

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System